May 26, 2010

James Kohlenberger, Chief of Staff
Office of Science and Technology Policy

Diana Farrell, Deputy Assistant to the President for Economic Policy
National Economic Council

Re: Commercialization of University Research Request for Information

Dear Mr. Kohlenberger and Ms. Farrell:

The University City Science Center, a nonprofit organization located in Philadelphia, Pennsylvania, hereby submits this letter in response to the Request for Information on Commercialization of University Research issued by the Office of Science and Technology Policy and the National Economic Council. Our QED Proof-of-Concept Program (QED) – which we established in early 2009 as a privately-funded pilot initiative, and subsequently expanded into a public-private partnership with government support – is the nation's first multi-institutional proof-of-concept center (POCC). As the founder and manager of QED, we are pleased to share with you our perspective on POCCs and, more broadly, the commercialization of university research and early-stage technologies.

Background on the University City Science Center

The Science Center is a private, independent, nonprofit research park and technology-based economic development organization serving the Greater Philadelphia region, which consists of Philadelphia County and the 10 surrounding counties in Southeastern Pennsylvania, Southern New Jersey and Northern Delaware. We are a 501(c)(3) corporation owned by 32 colleges, universities, hospitals and other nonprofit institutions located throughout the region. A list of our shareholders is attached to this letter.

Situated in West Philadelphia, adjacent to the University of Pennsylvania and Drexel University, the Science Center is the nation's oldest and largest urban research park. Our campus includes 2.0 million square feet of laboratory, office and medical facilities. Our mission is to accelerate technology commercialization and the market availability of life-enhancing scientific breakthroughs by bringing together innovators, scientists, entrepreneurs, funders, and business service providers.

Technology commercialization is a vital economic driver in the Greater Philadelphia region. Of the 350-plus organizations that have been incubated on the Science Center campus since our inception in 1963, 93 remain in the region. These companies employ more than 15,000 people at an average salary of $89,000, and they, along with our 30+ current incubator residents, contribute more than $9 billion to the regional economy annually.[1]

For additional background about the Science Center, I am enclosing with this letter copies of the Science Center's 2009 Annual Review and our recently published economic impact study, "The University City Science Center: An Engine for Economic Growth for Greater Philadelphia," prepared by the Economy League of Greater Philadelphia.

QED Proof-of-Concept Program

In early 2009, the Science Center launched the nation's first multi-institutional proof-of-concept program, to fund early-stage academic research projects in the life sciences and to promote the commercialization of the technologies resulting from those projects. Our program – named "QED", after the Latin phrase "*quod erat demonstrandum*" or "proven as demonstrated" – provides funding and business advice for academic researchers throughout the Greater Philadelphia region who are developing early-stage life science technologies with high commercial potential. QED helps promising researchers translate their publicly-funded basic research into privately-funded technology commercialization and product development opportunities. As angel investors, venture capitalists, and established companies increasingly shift their investments to later-stage initiatives, QED fills a critical gap in the innovation pipeline.

QED leverages the Science Center's relationships with universities, government agencies, and public and private companies, driving technology transfer and new business formation, advancing entrepreneurship, and encouraging innovation, competitiveness, and knowledge-base retention and expansion. The program's key operating principles for technology commercialization are (a) to focus existing regional resources on substantially reducing early-stage business risk, and (b) to evaluate and position early-stage technologies for follow-on

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[1] The University City Science Center: An Engine for Economic Growth for Greater Philadelphia (2009), prepared by the Economy League of Greater Philadelphia. Available online at www.sciencecenter.org

investment by established life science companies and private investors, thereby reducing the proliferation of sub-scale, undercapitalized ventures already in the market. Ultimately, the success of the program will be judged according to the metrics of academic technology transfer, including new venture formation, license execution, and outside investment.

We believe that our QED program can serve as an innovative and promising model for POCCs nationwide:

- **QED serves a tri-state "regional innovation cluster."** The Greater Philadelphia region is one of the top metropolitan areas in the nation for research and development in the life sciences. QED is a collaborative program that extends across the region, transcending state and local boundaries. The program catalyzes the transfer and commercialization of early-stage life science technologies emanating from universities, hospitals and research institutions throughout 11 counties in three states. As a hub of innovation, entrepreneurship and technology commercialization in the region – without any mandated allegiance to a particular state or locality, and without any limitations or restrictions imposed by government (or any other third party) on where we can operate or whom we can assist – the Science Center is a neutral intermediary organization that can bring the region's institutions and other assets together in order to produce tangible results that benefit all.

- **QED is multi-institutional.** QED began in April 2009 with 10 participating research institutions; the number of participants has since expanded to 17, with other institutions expected to join in the near future. Cooperation and competition among the institutions serve to increase the regional technology pool and leverage regional resources more effectively, ultimately maximizing the program's impact. Also, the broad range of institutional participants aligns well with the Science Center's role as a facilitator of the region's dominant "innovation ecosystem" in the life sciences. Although other organizations elsewhere in the country – notably MIT and the University of California at San Diego – offer similar business advisory and funding resources, their reach is limited to projects at the host institution. QED's multi-institutional scope features a diversity of institutional sizes and characteristics within a versatile program model that minimizes administrative overhead. We believe that this model can be readily adapted to other regions in the US.

- **QED leverages existing multi-disciplinary resources.** QED builds upon the Science Center's extensive relationships with research centers, tech transfer offices, entrepreneurs, investors, public and private companies, and economic development organizations in order to address the multiple aspects of commercialization for all projects that enter the program. In particular, third-party scientific and commercial guidance is a critical component of QED. This guidance takes the form of business advice from experienced investors, entrepreneurs and industry representatives; technical and clinical review of

technology by outside scientific reviewers; and market-based screening and selection teams that evaluate the projects with a focus on both the potential for follow-on investment and the anticipated market demand for the end-stage product.

- **QED is collaborative.** QED, by its nature, is a program that not only encourages, but demands, multidisciplinary collaboration between and among its participating institutions, principal investigators, business advisors, scientific reviewers, screening and selection team members, and prospective follow-on funders, thereby maximizing the prospects for high-quality, early-stage research with substantial end-stage market potential. It is this comprehensive approach that sets QED apart. Our intention is to organize and deploy the wealth of scientific, technological, and entrepreneurial talent and resources within our region – which transcend institutional, city, county, and state boundaries – towards a common goal of more efficient and effective life science commercialization.

- **QED strengthens an existing regional research capability.** A May 2009 report by the Milken Institute ranks the Greater Philadelphia life sciences "cluster" second among the 11 top life sciences clusters in the United States.[2] The Greater Philadelphia region's institutions of higher education excel at attracting research dollars; according to one study, the region attracted $1.5 billion in academic R&D funding in 2005, 62 percent of which was devoted to life sciences, followed by engineering and physical sciences.[3] That investment is paying off: the region averages 520 invention disclosures a year, surpassed only by Boston.[4] However, our region's universities and other research institutions are not achieving their full potential when it comes to economic development through entrepreneurship. QED is using technology transfer to spur economic development by successfully linking early-stage research with later-stage technology development and commercialization.

- **QED is an innovative public-private partnership.** From a funding/financing standpoint, QED represents a true "public-private partnership." The pilot phase of the program has received $300,000 in grants from the Commonwealth of Pennsylvania's Ben

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[2] The Greater Philadelphia Life Sciences Cluster 2009: An Economic and Comparative Assessment (2009), published by the Milken Institute. Available online at www.milkeninstitute.org

[3] Accelerating Technology Transfer in Greater Philadelphia: Identifying Opportunities to Connect Universities with Industry for Regional Economic Growth (2007), prepared by the CEO Council for Growth. Available online at www.selectgreaterphiladelphia.com

[4] Ibid.

Franklin Technology Development Authority (with an additional $100,000 grant expected in 2011); in addition, the Science Center has received a $300,000 grant from the William Penn Foundation. However, since the program's inception the bulk of its funding has come from the Science Center and the participating institutions themselves. A total of $1.8 million has been committed by the Science Center and the participating institutions during the pilot phase of QED, to cover costs incurred by award recipients in connection with funded projects; in addition, the Science Center is contributing an additional $1.0 million to cover general program operating expenses. Each of the nine research proposals that are selected for funding through the pilot will receive $100,000 from the Science Center and a matching $100,000 from the host institution. The Science Center continues to seek additional funding from Federal agencies and other government sources, as well as additional funding from private sources in order to increase (and leverage) the economic impact of any public dollars invested.

For all of the foregoing reasons, we believe that our QED Proof-of-Concept Program represents a new paradigm for technology development, in which neutral "commercialization intermediaries" like the Science Center can serve as facilitators. These intermediaries can, uniquely, promote greater collaboration and dialogue among the various stakeholders in the technology transfer process, which are essential to the emergence of successful POCCs that accelerate commercialization into the marketplace. They can also help to align often-mismatched incentives and cultural differences between academia and industry, creating an environment that supports the successful flow of R&D from basic research, through proof-of-concept projects, to product development and technology commercialization.

Importantly, the opportunity exists to scale up, expand and/or translate the QED program to other parts of the nation; to other sectors of the technology economy, such as energy and cleantech; to large companies with specific needs no longer supported by their own R&D capabilities; and to Federal laboratories with under-commercialized research output. Organizations – such as the Science Center – that have a proven track record in technology commercialization can be utilized as reference points, in order to develop a national model for efforts to accelerate commercialization.

Federal agencies should encourage organizations that are working on similar initiatives to work together in a meaningful collaborative process that will allow funding to be more effectively deployed, thereby increasing the likelihood of successful outcomes. These outcomes will include the creation and growth of high-tech companies, high-paying jobs, and high-demand medicines, medical devices and other technologies that, in turn, will fuel economic development in the United States and beyond. Regional strengths can be emphasized, and appropriate

incentives to collaborate and communicate can be provided, in order to foster an environment that facilitates the productive exchange of ideas and technologies.

Attached for your review, following the list of Science Center shareholders, is a comprehensive discussion of the various elements of our QED program, including (a) an outline of how the program is administered, (b) a summary description of each of the six projects selected for funding to date, and (c) a discussion of the program's anticipated deliverables.

Please feel free to contact me if you have any questions or comments on this letter or the attachments, or if you would like any additional information. In addition, I would be happy to meet with you at your convenience to discuss the QED program in more detail, and I invite you to visit us here at the Science Center in Philadelphia to tour our facilities and learn more about who we are and what we do to support technology commercialization and economic development in the Greater Philadelphia region.

Thank you for your consideration.

Sincerely,

Stephen S. Tang, Ph.D.
President & CEO

UNIVERSITY CITY SCIENCE CENTER

List of Shareholders

The American College, Bryn Mawr, PA
Bryn Mawr College, Bryn Mawr, PA
Burlington County College, Pemberton, NJ
The Children's Hospital of Philadelphia, Philadelphia, PA
Delaware State University, Dover, DE
Drexel University, Philadelphia, PA
East Stroudsburg University, East Stroudsburg, PA
Haverford College, Haverford, PA
Lafayette College, Easton, PA
Lehigh University, Bethlehem, PA
Lincoln University, Chester County, PA
Mercy Health System, Conshohocken, PA
NUS America (National University of Singapore), Philadelphia, PA
The Penjerdel Council, Philadelphia, PA
Pennsylvania Hospital, Philadelphia, PA
Philadelphia College of Osteopathic Medicine, Philadelphia, PA
Philadelphia University, Philadelphia, PA
The Presbyterian Foundation for Philadelphia, Philadelphia, PA
Rowan University, Glassboro, NJ
Rutgers, The State University of New Jersey, New Brunswick, NJ
Salus University (former Pennsylvania College of Optometry), Elkins Park, PA
Swarthmore College, Swarthmore, PA
Temple University, Philadelphia, PA
Temple University School of Podiatric Medicine, Philadelphia, PA
Thomas Jefferson University, Philadelphia, PA
University of the Arts, Philadelphia, PA
University of the Sciences in Philadelphia, Philadelphia, PA
University of Delaware, Newark, DE
University of Pennsylvania, Philadelphia, PA
Villanova University, Villanova, PA
West Philadelphia Partnership, Philadelphia, PA
Widener University, Chester, PA

UNIVERSITY CITY SCIENCE CENTER

QED Proof-of Concept Program:
A New Regional Platform for Technology Commercialization

Introduction

This paper discusses the background, rationale, and operating mechanics of the new QED Proof-of-Concept Program being spearheaded by the University City Science Center within the tri-state region including and surrounding Philadelphia. Launched in April 2009 and now about to enter its third funding cycle, the QED program is a regional collaboration that catalyzes the transfer and commercialization of early-stage life science technologies from universities, hospitals and other research institutions in Pennsylvania, New Jersey and Delaware.

Genesis of the QED Proof-of-Concept Program

In the context of technology commercialization, the "valley of death" refers to the barrier between early-stage technology at universities and federal laboratories and follow-on development in the private sector. Particularly in recent years, private capital for R&D has moved steadily "downstream", as investors and corporations favor later-stage, lower-risk technologies. This leaves many early-stage technologies, the supply of which has actually increased (as manifested by the number of scientific papers, invention disclosures, and patent applications), stranded in the laboratory. The question is, as the pipeline of biomedical products "dries up", how will the development of new products be sustained? This issue is currently receiving greater attention, as public policymakers and economic development organizations consider new ways to generate more value from the billions of dollars that are allocated to universities each year in research grants.

In 2007, the CEO Council for Growth, an affiliate of the Greater Philadelphia Chamber of Commerce, released the results of a comprehensive study that directly addressed early-stage technology commercialization in the region. The report, Accelerating Technology Transfer in Greater Philadelphia[1], highlighted the region's cultural and funding constraints on converting university research into products, businesses, and economic development.

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[1] Accelerating Technology Transfer in Greater Philadelphia: Identifying Opportunities to Connect Universities with Industry for Regional Economic Growth (2007), prepared by the CEO Council for Growth. Available online at www.selectgreaterphiladelphia.com

Starting in early 2008, the Science Center conducted its own market research into technology commercialization in Greater Philadelphia, and explored what the Science Center could do to complement and collaborate with other organizations and participants in the tri-state technology "innovation ecosystem." Building upon its heritage as the largest and oldest urban research park in the nation, the Science Center sought new ways to leverage its university affiliations, regional relationships, and central location to help accelerate technology commercialization.

The model for QED was built by first conducting a baseline analysis of "best practices" with respect to POCCs and other similarly-focused commercialization programs. The Ewing Marion Kauffman Foundation, the world's largest foundation devoted to entrepreneurship, has identified POCCs as a promising model for supporting technology commercialization from academic research institutions.[2] A number of leading POCCs exist in the United States. These include the Deshpande Center at the Massachusetts Institute of Technology (MIT),[3] the Von Liebig Center at the University of California at San Diego (UCSD),[4] and the California Institute for Quantitative Biosciences (QB3) at the University of California at San Francisco (UCSF).[5] The Science Center benchmarked, through primary research and interviews with these centers' directors, the operational characteristics of successful POCCs. However, these are all single-institution entities; so, in order to effectively address technology commercialization more broadly throughout the Greater Philadelphia region, the Science Center decided to develop the QED program as a truly multi-institutional proof-of-concept program, the nation's first.

Following a full year of research, design, and implementation planning, the Science Center began the QED Proof-of-Concept Program in early 2009.

Goal and Structure of the QED Program

The Science Center launched the QED program with its inaugural funding cycle in April 2009, following the negotiation and execution of a single operating agreement coordinating the participation – on a level playing field, with equal terms and conditions – of 10 leading universities, hospitals and other research institutions located throughout the region:

Children's Hospital of Philadelphia, Philadelphia, PA
Drexel University, Philadelphia, PA
Lankenau Institute of Medical Research, Wynnewood, PA
Rutgers University, New Brunswick, NJ
Temple University, Philadelphia, PA
Thomas Jefferson University, Philadelphia, PA
University of Delaware, Newark, DE
University of Pennsylvania, Philadelphia, PA
University of the Sciences in Philadelphia, Philadelphia, PA
The Wistar Institute, Philadelphia, PA

[2] www.kauffman.org/advancing-innovation/proof-of-concept-centers.aspx

[3] web.mit.edu/deshpandecenter

[4] www.vonliebig.ucsd.edu

[5] www.qb3.org

The operating agreement defines protection of intellectual property, institutional matching contributions, restrictions of expenditure on overhead, and revenue sharing from successful projects for program sustainability.

The fundamental goal of the QED program is to help convert more academic research into clinical and market products, through four basic operating characteristics:

- Identification of life science technologies (for the pilot phase of the program) that address significant unmet clinical needs
- Matching of scientific expertise with relevant business guidance, to ensure that proposed research projects answer questions relevant to commercial development
- Utilization of "market pull" (rather than "technology push") in the selection of projects that receive funding
- Provision of individual project funding through a 50/50 match between the Science Center's core QED fund and the university or other research institution owning the selected technology (this model of joint support enables research organizations to be participants in the program, rather than simply recipients of funding; ownership of all IP is retained by the research organization and transitioned into new venture or licensing opportunities according to its own institutional policies)

The program's desired outcome, over time, is a portfolio of technologies that are well-positioned to attract private investment, technology licensing, and/or sponsored research.

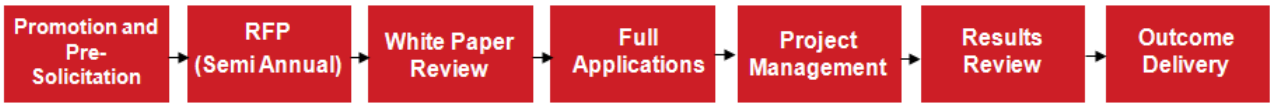
The QED program goes well beyond the typical "gap fund" offered to scientists at some universities today. Indeed, one can think of the basic structure of QED as a three-legged stool. The first two legs – good science and sufficient funding – are the logical starting points. That, however, is where most gap funds stop. QED adds comprehensive commercial guidance, the third leg of the stool, in the form of business advisors, technical and clinical review of technology by third-party reviewers, and market-based screening and selection teams that represent the views of prospective customers of the evaluated projects. This third leg of the stool adds more complexity to the process, driving the need for strong program management.

In sum, the basic structural formula for the QED program is:

Technology + Funding + Commercial Guidance,
all integrated by Tight Program Management

Process Flow and Mechanics

The box-and-wire diagram below shows the basic process flow of the QED program. It is a batch process, where the first six months of each cycle comprise several steps leading to the selection of proof-of-concept projects which are implemented over the subsequent 12 months (assuming that project milestones are met along the way).

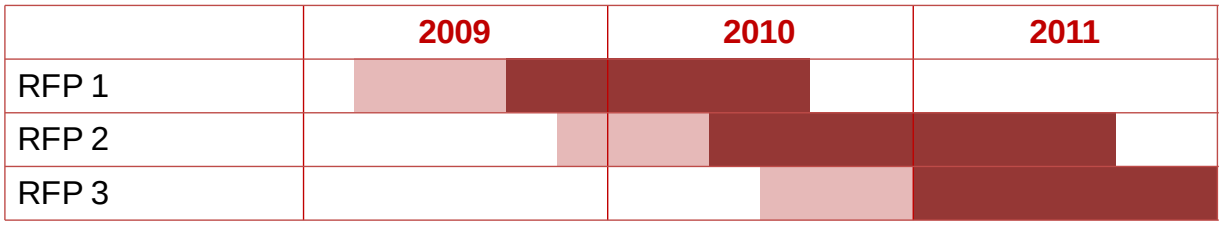


The cycle starts with the solicitation of brief "white paper" proposals through a Request for Proposals, or RFP. White papers, written primarily by academic scientists at the participating institutions, briefly describe the technologies being proposed for development. These proposals are then screened by a team of evaluators from companies and investment firms to identify a smaller number (we currently select 8-10 per cycle) that warrant further consideration as full applications.

The short-listed projects are then matched with business advisors. These business advisors are entrepreneurs, investors and industry veterans from throughout the Greater Philadelphia region. They are recruited to the program by the Science Center, and matched to projects with the help of BioStrategy Partners, a technology and business development services firm based in Montgomeryville, PA. The scientist and business advisor for each project, assisted by one or more MBA students (recruited from the region's business schools through a competitive process), and working with the technology transfer office of the scientist's home institution, then develop the full application over a two-month period. Each application describes in detail the potential developmental path for the technology, including the product that will result, the need it meets, and the necessary R&D that will "prove the concept" of the technology sufficiently to allow its transition to the private sector (or, conversely, to rapidly and cost-effectively disprove its utility or marketability).

The full applications – each accompanied by a technical evaluation coordinated by the American Institute of Biological Sciences in Reston, VA – are then reviewed by a 20-person selection team made up of scientists, life science industry executives, investors, entrepreneurs, venture capitalists, and economic development officials. This review culminates in a full-day selection team meeting, featuring a series of 20-minute oral presentations by the scientists and their advisors. The selection team then makes its recommendations on the suitability of each project for funding. Each project that is selected for funding receives up to $200,000 for a 12-month period, for proof-of-concept work and analysis of the potential for product development and technology commercialization.

Schedule of RFP Funding Cycles



The first three cycles of the QED program are depicted above. In each cycle, project selection and planning activities (light shading) are followed by funding and implementation of up to three selected projects for 12 months (dark shading). Each cycle includes a range of concurrent management activities that are not depicted in the diagram, including recruitment and induction of participating research institutions, promotion of the opportunity to academic communities, development of business advisor and MBA student communities, enlisting professionals for the selection team, interim assessment of processes for operational improvement, and marketing of funded projects to potential follow-on investors.

Program Implementation Update (May 2010)

One year into the QED program, the selection of projects for the first two cycles has been successfully completed, and the third cycle is about to get underway.

First Cycle

In the first cycle, the program received a total of 73 white paper proposals from all 10 participating institutions. An eight-person screening team reviewed, discussed, and scored the proposals, choosing 10 for further development into full applications. From these, a 20-person selection team chose the following three projects for funding:

- A portable, low-cost, radiation-free breast cancer screening device for use in women with dense breasts, being developed by a team led by Wan Shih, Ph.D., of Drexel University. The proposed device could be used as an adjunct to mammography (particularly for women under 40), or for use in parts of the nation and world where mammography is not readily available.

- Nanostructured thin films for reducing bacterial infection via external bone fixator pins, being developed by a team led by Paul Ducheyne, Ph.D., of the University of Pennsylvania. If successful, these films will reduce the currently high complication rates that are observed when compound fractures are repaired using external fixation.

- A handheld wound-healing monitor being developed by Elisabeth Papazoglou, Ph.D., and her team at Drexel University. This device would provide an objective method for healthcare professionals to assess healing in complex wounds, such as diabetic ulcers, helping to reduce costs and avoid dire results such as amputation.

Second Cycle

The second application cycle began in mid-October 2009 and ended in early May 2010. In this cycle, 16 universities and other research institutions participated – the original 10 participants plus the following additional institutions:

Delaware State University, Dover, DE
Fox Chase Cancer Center, Philadelphia, PA
Lehigh University, Bethlehem, PA
Monell Chemical Senses Center, Philadelphia, PA
Philadelphia College of Osteopathic Medicine, Philadelphia, PA
Widener University, Chester, PA

In the second cycle, the program received a total of 61 proposals from 14 of the 16 participating institutions. After screening, application development, and final presentation, the following three projects were selected for funding:

- A technology being developed by Robert Levy, M.D., of The Children's Hospital of Philadelphia that is expected to significantly reduce the 100,000 surgeries performed each year in the US to replace stents that are used to treat arterial blockages but become blocked themselves over time. The proposed technology uses magnetically-charged nanoparticles to deliver circulation-preserving drugs to implanted stents.

- A minimally invasive technique for replacing damaged heart valves, being developed by a group headed by Joseph Gorman III, M.D., of the University of Pennsylvania. The novel valve replacement uses a specially designed folding, anchoring, and sealing mechanism that enables it to be introduced through a peripheral blood vessel and placed in the heart without the need for cardiopulmonary bypass. Its development will make heart-valve replacement possible for 10 times as many patients, most of whom are too sick to tolerate the surgical procedure in use today.

- A new method of gene "silencing" being developed by a team led by Samuel Gunderson, Ph.D., of Rutgers University that is designed to reduce problems of delivery, stability, and immune reactivity associated with existing technologies. The ability to "switch off" genes in living cells and organisms is indispensable in the discovery of gene functions, and has become increasingly recognized as a viable therapeutic option for many genetic diseases.

Third Cycle

The third application cycle is expected to begin in June 2010. In this cycle, 17 institutions are expected to participate -- the 16 institutions that participated in the second cycle, plus Harrisburg University of Science and Technology, located in Harrisburg, PA. The formal RFP for the third cycle is currently being developed.

Affiliations of Screening and Selection Team Members

Members of the screening and selection teams for the first and second cycles are affiliated with the following firms and organizations, representing a cross-section of the diverse public and private interests that participate in, and support, technology commercialization in Greater Philadelphia:

Angel Investors

Delaware Crossing Investor Group, Doylestown, PA
First State Innovation, Wilmington, DE
Harrell Capital Partners, Chevy Chase, MD
IP2Biz, Atlanta, GA
Mid-Atlantic Angel Group, Philadelphia, PA

Consulting and Financial Management

BSG Advisors, Berwyn, PA
Exponent, Philadelphia, PA
InVenture Partner, New York, NY

Economic Development

Ben Franklin Technology Development Authority, Harrisburg, PA
Ben Franklin Technology Partners of Southeastern Pennsylvania, Philadelphia, PA
BioAdvance – The Biotechnology Greenhouse Corporation of Southeastern Pennsylvania, Philadelphia, PA
New Jersey Commission on Science and Technology, Trenton, NJ

Pharmaceuticals and Medical Devices

FemmePharma Global Healthcare, Wayne, PA
GlaxoSmithKline, Philadelphia, PA
Integra LifeSciences, Plainsboro, NJ
Johnson & Johnson, New Brunswick, NJ
Merck, Whitehouse Station, NJ
NeuroDx Development, Bensalem, PA

Private Equity and Venture Capital

Main Line Ventures, Berwyn, PA
MentorTech Ventures, Philadelphia, PA
NewSpring Capital, Radnor, PA
Quaker BioVentures, Philadelphia, PA
Safeguard Scientifics, Wayne, PA

Learning by Doing

QED staff members are learning, recording, and improving operational features of the program on an ongoing basis. During the pilot phase of the program, the evaluation of the program's success is concentrating on metrics of implementation, including organizational inclusion across the region, submission of technology descriptions by scientists at each research organization, quality of technologies being pitched, participation by regional entrepreneurs as business advisors, and engagement of industry and investment professionals in the evaluation and selection of projects for funding.

At strategic times during the implementation of each program cycle, a combination of written surveys and interviews are used to solicit feedback from scientific investigators, technology transfer personnel, selection team members, business advisors, MBA students, and representatives of the local business schools from which the MBA students are drawn. Areas of interest include the effectiveness of various program activities, including promotion, RFP solicitation, the white paper application process, project screening, and resources provided

during the preparation of full applications. The preliminary findings indicated that two aspects of the program are critical to its success: (a) the outreach to, and education of, regional scientists in the fundamentals of translational research, and (b) the provision of well-managed business guidance even at the earliest proof-of-concept stages of a project. As a result of the synthesis and evaluation of this information, a number of improvements have been included in the program since the completion of the first cycle. These include:

- Earlier information sessions on the program and its goals, held on institutional campuses
- Publication of guides and FAQs for potential applicants
- Webinars and live workshops for potential applicants
- Greater involvement of business advisors in self-selecting and project matching
- "Open house" events for prospective MBA student advisors

Program Deliverables

Although the ultimate impact of the program on technology transfer in the region cannot be expected to be realized until 3-5 years after the launch of the program, it is anticipated that successful projects will result in either licensing or new small company formation, without any bias. The participating institution's technology transfer office and the principal investigator will make the decision to license or to form a new company according to the best interests of the technology, with advisory input from the QED steering committee and the QED business advisor assigned to the project. These results will ultimately reflect the program's level of overall success.

In addition to the direct benefits of commercial guidance (and, potentially, funding) received by successful applicants, there is also a benefit derived by the business advisors and student fellows through the collaborative and entrepreneurial learning experience. Not only are we working to develop a network of science and technology entrepreneurs – we are also creating an environment that encourages meaningful interaction between academic and commercial interests, resulting in (a) the provision of earlier commercial guidance to research technologies, (b) the creation of avenues for experienced entrepreneurs to identify new opportunities, and (c) the opportunity for students to gain real life, valuable experience in entrepreneurship.

More immediate indicators of success include:

- Evaluation and feedback to non-funded projects, better positioning them for funding from other programs
- Re-direction of limited resources from projects that prove to be unsuitable for commercial development
- Assembly of a comprehensive regional inventory of life science technologies with potential commercial value, creating a pipeline of commercially-evaluated technologies that are capable of bridging the "valley of death"

Longer-term indicators of success will include:

- Increased number of direct and indirect jobs, and per-capita wealth
- Development of new life science products which will improve the quality and efficiency of healthcare

The ultimate success of the QED program will be determined by the transfer of successful R&D proof-of-concept projects to the private sector. Meanwhile, program participants will continue to "learn by doing", to improve process productivity with each cycle, and to establish the basis for program continuation and scale-up.

Program Sustainability

The Science Center is committed to continuing to move the QED program forward. Participating research institutions have each committed $100,000 of matching funds to any project submitted from their institution that is selected for funding. The Science Center and the participating research institutions have negotiated a share in licensing revenues and company equity that arise from successful QED projects. However, it is anticipated that long-term sustainability will require the formation of an endowment. Public policy changes should be instituted that would ease the current burden of financing this program until an endowment is substantially funded. Ultimately, we anticipate that demonstration of the program's success will encourage support from corporate partners. This process could be accelerated by providing tax incentives for private investment.